PROBLEMS OF MEDICAL EVACUATION IN COLD WEATHER

OFFICE OF NAVAL RESEARCH

U.S. ARMY RESEARCH INSTITUTE OF ENVIRONMENTAL MEDICINE

OCTOBER 1977

OFFICE OF NAVAL RESEARCH

AND

US ARMY RESEARCH INSTITUTE OF ENVIRONMENTAL MEDICINE

JOINT WORKING GROUP

ON

PROBLEMS OF MEDICAL EVACUATION IN COLD WEATHER

HOLIDAY INN - GOVERNMENT CENTER,

BOSTON, MA

31 OCTOBER - 3 NOVEMBER 1977

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PURPOSE OF THE MEETING

The purpose of this meeting was to determine requirements for the management of casualties in a cold weather military operation. Making these recommendations were representatives from the Army, Navy, Marine Corps, National Guard, Coast Guard, National Ski Patrol, civilian physicians, DOD and civilian scientists as well as civilian and military representatives from several foreign countries. Individual participants were selected for their diverse expertise: (a) those having past experience in cold weather operations; (b) those responsible for generating needs; (c) those involved in decision making; (d) those tasked with solving the problems; and (e) those involved in formulating doctrine.

The group attempted to discuss the entire range of problems associated with cold weather casualty management: (a) locating the casualty on the battlefield; (b) getting to the casualty on the battlefield; (c) treating the casualty with the added complications of exposure to cold, wetness and wind; and (d) evacuating the casualty to definitive care facilities. The conference identified specific problems and established a set of priorities for solving them. Changes in training and doctrine were recommended as well as research and development efforts to solve specific problems. The major thrust of the conference was not to "point fingers", but to indicate the seriousness of deficiencies in cold weather casualty management and the critical need for improvement.

PROGRAM REVIEW

On Monday (31 October) and briefly on Tuesday (1 Nov) there were presentations by both military and civilians with experience and knowledge of cold weather problems. These talks were not intended to be in-depth analyses but only to jog the memories of the participants, and hopefully bring to bear different disciplines to attack the specific problems of medical evacuation in cold weather. A review of the names and agencies represented revealed that there were present many famous scientists and experienced commanders with a wide variety of expertise. The interest in this conference was very high and participants were urged to make the most of this opportunity because of the extent of enthusiastic and knowledgeable people available.

Monday evening was allocated to an informal get-together which allowed participants to meet one another and formulate ideas for the working groups. The working groups, which began on Tuesday, discussed four broad areas: (1) Search & Rescue and Communications, (2) Training and Doctrine, (3) Patient Needs, and (4) Logistics & Equipment. There were 8 hours set aside for the function of each working group.

Tuesday evening was used for an informal discussion of hypothermia for interested individuals. It was originally thought that this would be a small group of 10-20 persons, but over 50 attended a 3 hour session. Many of the world's experts on hypothermia were present, with the topics of prevention, treatment, and current research discussed.

Working groups continued through Wednesday morning followed by a briefing and tour of NARADCOM and USARIEM Wednesday afternoon. Wednesday evening was left open to allow for any last minute efforts before working group summaries were presented to the meeting as a whole on Thursday.

On Thursday, working group presentations took place with time for general participation and discussion. At this time, the conference as a whole was able to discuss specific areas brought up in the individual working groups. Areas of agreement and disagreement were noted as detailed later in this report.

PROGRAM AGENDA

Sunday, 30 October 1977

1600 - 1900	REGISTRATION Lobby of Holiday Inn, Government Center, Boston, MA

Monday, 31 October 1977

0730 - 0800	REGISTRATION
0800	WELCOME AND INTRODUCTIONS COL Harry G. Dangerfield, MC, USA
0810	US MARINE CORPS CONCERN AND REQUIREMENTS BG Francis W. Tief, USMC
0830	US ARMY MEDICAL RESEARCH & DEVELOPMENT COMMAND CONCERN AND REQUIREMENTS COL LeeRoy G. Jones, MC, Deputy Commander
0845	US NAVY MEDICAL RESEARCH & DEVELOPMENT COMMAND EFFORTS AND PRIORITIES CAPT Joseph Bloom, USN
0900	DOCTRINE AND PLANNING FOR COLD WEATHER MEDICAL OPERATIONS Dr. Richard H. Ross (MD)
0915	TO&E EQUIPMENT FOR MEDICAL COMPANY CPT Joseph P. Gonzales
0925	THREAT ANALYSIS MAJ Jerry Brown, MSC (Ph.D)
0935	BREAK
0945	TRI-SERVICE APPROACH TO COLD WEATHER RESEARCH RADM Robert Geiger, USN
1000	THE TRAINING OF MEDICS Army - CPT Joseph P. Gonzales
1010	Navy - CDR Charles T. Cloutier, USN

1020 National Ski Patrol - Dr. Warren Bowman (MD)

1030 THE IMPACT OF COLD ON THE PATIENT

Dehydration - CPT Joel J. Berberich, MSC (Ph.D)

1045 Frostbite - Dr. William J. Mills, Jr. (RADM, MC USNR)

1100 Hypothermia - Dr. John Hayward

1115 THE HARD FACTS OF OVER-SNOW MOBILITY
Dr. Richard L. Burse (Sc.D)

1130 PROTECTION AGAINST THE COLD FOR THE CASUALTY AND THE WORKER
Dr. Ralph Goldman (Ph.D)

1150 LUNCH

1300 HISTORICAL REVIEW AND CASUALTY STATISTICS U.S.
MAJ James E. McCarroll, MSC (Ph.D)

1320 CURRENT EFFORTS AND TRAINING IN MEDICAL CARE

Army - CPT Craig Lewis

1330 Korea - COL Richard A. Torp (MD)

1350 Navy, Marine Corps - CDR George S. Harris

1400 National Guard - MAJ Gerald Forslund

1410 Coast Guard - CAPT Leon R. Jellerson (MD)

1420 Canadian - LTC R. C. Rud

1430 National Ski Patrol-Dr. Warren Bowman (MD)

1440 USSR - Ms. Carolyn Stettner

1450 Norway - LTC Carl-Fredrik Tidemann (MD)

1510 BREAK

1520 EXPERIENCE OF INDIVIDUALS

Dr. E.E. Hedblom (CPT,MC,USN)(Ret)

1530	COL Richard F. Barquist (MD)
1540	Dr. William H. Doolittle (MD)
1550	CPT Craig Lewis
1600	COL Robert Looney
1610	MWO R.G. Cooper
1620	Dr. Cameron Bangs (MD)
1630	Mr. Peter Furhmann
1640	LTC Carl-Fredrik Tidemann (MD)
1730	INFORMAL GATHERING

Tuesday, 1 November 1977

0800	AVIATION PROBLEMS IN COLD AND SNOW CPT Charles C. Thompson
0820	COMMUNICATION PROBLEMS CPT Herbert Dyer
0835	MEDICAL EVACUATION STUDY IN ALASKA 1976 LTC Michael Young (MD)
0850	CURRENT R&D EFFORTS
	USMBRDL - Mr. William C. Prensky
0900	USARIEM - MAJ Ronald Jackson, MC, USA
0910	CDA, ALASKA - Mr. William Pitts
0930	COAST GUARD - CAPT Lean R. Jellerson (MD)
0940	MARINE CORPS - MAJ Richard Pierzchala
0950	CANADIAN - Dr. Lloyd Reed
1000	NORWEGIAN - LTC Carl-Fredrik Tidemann (MD)
1020	TASKING OF THE WORKING GROUPS Dr. Murray P. Hamlet (D.V.M.)
1030	BREAK

1040	WORKING GROUPS
1200	LUNCH
1300-1450	WORKING GROUPS
1450-1500	BREAK
1500-1700	WORKING GROUPS
1930	HYPOTHERMIA DISCUSSION FOR INTERESTED PERSONS
	Wednesday, 2 November 1977
0800-1115	WORKING GROUP SESSIONS
0930-0940	BREAK
1115	LUNCH
1200	BUS TO NATICK FOR TOUR OF NARADCOM AND USARIEM (Return approx. 1700 hours)
	(JMRC Meeting - Time to be announced)
	EVENING OPEN FOR DISCUSSION AND SESSIONS OF WORKING GROUPS, IF NECESSARY
	Thursday, 3 November 1977
0800	WORKING GROUP 1 (SEARCH & RESCUE AND COMMUNICATIONS) Summary & Discussion
0950-1000	BREAK
1000	WORKING GROUP 2 (TRAINING & DOCTRINE) Summary & Discussion
1200	LUNCH
1300	WORKING GROUP 3 (INVENTORY OF PATIENT NEEDS) Summary & Discussion
1450-1500	BREAK
1500	WORKING GROUP 4 (LOGISTICS & EQUIPMENT) Summary & Discussion
1700	EXIT COMMENTS Dr. Murray P. Hamlet (D.V.M.)

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Working Group #3 - Inventory of Patient Needs

*CDR James Bond - Chairman
+ CPT Lynn R. Trusal - Recorder

Working Group #4 - Logistics & Equipment

*COL Robert Looney - Chairman
+ CPT Joel Berberich - Recorder

OPENING REMARKS

A TRI-SERVICE APPROACH TO COLD WEATHER MEDICAL RESEARCH

Rear Admiral Robert K. Geiger, USN

Good morning, I am happy that the Office of Naval Research has been able to join the Army Research Institute of Environmental Medicine in sponsoring this workshop on problems of Medical Evacuation in cold weather, and I am pleased to contribute a few remarks along with those of Generals Augerson and Tief.

The Navy has a long history of interest in cold regions and in cold environments. The explorations of Admiral Peary in the arctic in 1909 and those of Admiral Byrd in the antarctic in the 1920's and later are well known. But even before the discovery of the North Pole, explorations were conducted by a number of people that included Elisha Kane, the senior medical officer of the vessels ADVANCE and RESCUE, in 1853. A century later, in 1958, the nuclear submarine NAUTILUS, became the first ship to make the trans-polar crossing under the ice cap.

We have been involved in cold environments not only as explorers, but more significantly in research. Through the years, the Office of Naval Research has supported arctic research which has anticipated, by many years, the need to develop capabilities for operating effectively in cold climates.

In 1946, Vice Admiral H. B. Bowen, the first Chief of the Office of Naval Research, proposed the establishment of an arctic research laboratory to conduct effective investigations in arctic environments.

In 1947, the Naval Arctic Research Laboratory was established at Point Barrow, Alaska, some 300 miles north of the Arctic Circle. The first research program consisted of collecting information on metabolic activity, bird physiology and navigation, and vitamin content of arctic flora and fauna. Through the years, the programs and facilities of NARL have expanded and now include equipment and scientists for research in a spectrum of sciences, including geophysics, atmospheric physics, meteorology, oceanography, ice dynamics, climatology, hydroacoustics.

I should also like to mention the work in cold weather metabolism and bioenergetics. This is a significant portion of all the arctic biological research taking place in the world. The aim of this work is to acquire knowledge of the physiological processes that allow animals to survive the rigors of the arctic. This knowledge is necessary to increase man's tolerance to the arctic stresses, perhaps through diet modification or chemical therapy.

Besides the Navy, other government agencies and private institutions take advantage of the unique research facilities provided by NARL. The Department of the Interior and the Department of Energy are among these. It is my opinion that the facilities and location of the Laboratory could provide opportunities for research to the other Services.

Cold regions research underlines the strategic as well as economic importance that cold regions are assuming.

This increased importance of the cold regions emphasizes an increased ability of humans to operate in these environments.

Throughout history there have been many illustrations, some of them quite recent, that the ability to operate in cold environments has a great influence on the outcome of a military campaign, and can destroy the advantage of superiority in men and equipment. Consider the decimation of Napoleon's Grand Army in the Russian campaign of 1812. Again, in the 1940's, "General Winter" played a preponderant role in defeating the seemingly invincible German army. Our own experience in Korea where thousands of U.S. Marines suffered cold injuries, further points to the need for cold weather operational capability.

Cold weather is a very powerful adversary which can incapacitate many weapon systems. Most important, however, it can incapacitate the human operator of these systems.

We sometimes tend to forget that the human operator is a most essential element in any weapon system. It is therefore necessary that we devote research efforts to the maintenance of the integrity of this essential human element.

It is obvious today, by the fact that we are assembled at this symposium on "Problems of Medical Evacuation in Cold Weather," that this need for cold weather operational research is not only recognized, but also being addressed. It is gratifying to see that these operational needs are being addressed on a Tri-Service basis. I particularly welcome the representatives of our NATO allies. Because of the geographical characteristics of our allies and their experience, they can, I am confident, provide valuable insights into the problems we are examining at this workshop.

The main goal of this workshop is the development of requirements. No less important, however, is the utilization of these requirements once developed. It is not an uncommon situation to see an identified problem "sitting on the shelf" waiting for a solution, because the proper agency which could provide the solution is either unaware of the problem or has not assigned the proper priority to it.

The point that I would like to make is that identification of a problem is only one step in a scientific management system. The total goal should be to identify the problem, solve the problem, and bring the solution to operational use. Many times, application of the solution to operational use is more difficult than solving the problem itself.

In any research program, such as the one under consideration at this workshop, we should consider a number of administrative as well as scientific actions which will insure timely and effective operational application.

Among the scientific and administrative actions that should be considered I would suggest the following:

- First, obviously, define the problems;

- Recommend areas of research and development aimed at these problems.

- Insure that statement of the existing requirements be directed to the proper agency for solution.

- Once the requirements are in the proper agency, procedures should be established to follow-up and monitor action taken on these problems.

- Recommend a procedure to maintain a central repository in order to have an information data bank on current cold weather medical operational status, equipment availability and capability.

- It is important that we have continuing coordination and cooperation with NATO government laboratories which have demonstrated a great capability in this area (CANADA, NORWAY).

- Of paramount importance is a close cooperation of the U.S. Navy and the Air Force with the U.S. Army. This cooperation is of particular importance since the Army has the principal research program of the three Services.

(In this regard, I would like to invite the research managers of the Army to examine the research facilities and assets of the Naval Arctic Research Laboratory, mentioned above, with a view toward the potential utilization of these assets by their programs.)

The problems presented by cold environments may be somewhat different for the three Services. However, they have in common a very important factor: They can degrade the operations of all three Services.

The best method to identify and attack these problems and reduce the insult of cold weather is for us to pool our knowledge and experience and cooperate in the attack.

SUMMARY OF OPENING REMARKS ON MARINE CORPS REQUIREMENTS
BG Francis W. Tief

Recent experiences in military cold operations have served to show that we have not made much advancement since the Korean War. Marines equipped for cold exercises in Watertown, NY (1976) were given the same type of boots, waterproof trousers, parka and head gear used during the Korean War. A peacetime atmosphere has caused us to put emphasis on the ability of a boot to maintain a high gloss shine rather than its ability to keep a soldiers feet dry in a cold wet environment, such as Norway. There is a tremendous lack of training dealing with the specific problems in the cold. Those in command positions are not aware of the necessary precautions needed to protect their men from cold injury. Because of this lack of preparedness, we would be hard pressed to carry out a mission under wartime conditions in a cold environment.

The major concern of a commander is prevention of cold injury, not treatment of such casualties. From the top of his head to his feet the Marine needs better equipment specifically designed to meet the problems occurring in the cold. We need to know ways of obtaining water to prevent dehydration which occurs in troops under these conditions. Melting snow cannot be the answer due to heat-seeking weapons and the strain this places on limited energy resources. Better lubricants are needed so that equipment can operate at low temperatures. Above all, the commander needs a central source of information dealing with cold related problems. With such a source a commander should be able to obtain information about the prevailing conditions and what things are needed to meet these conditions. Such a source should be computerized and easily accessible.

In conclusion, there is a tremendous amount of work which needs to be initiated by this conference. If we let this opportunity slide by as just another conference with another voluminous report, which nobody pays any attention to, then we have not discharged a moral obligation all of us have to the young men of the American Armed Forces.

NAVY MEDICAL RESEARCH & DEVELOPMENT COMMAND EFFORTS AND PRIORITIES

CAPT Joseph Bloom

Good morning and greetings from the Naval Medical Research and Development Command. I believe that in keeping with the concept of a working group, my remarks should be more in the nature of an informal short discussion rather than a formal speech. I am truly pleased to be invited to participate with you in the assessment and planning for problem solving in Medical Evacuation in Cold Weather. I do not meet all the criteria of a participant as to having experience or background in medical evacuation. I do, however, have an active interest in cold weather operations, and hope to demonstrate in the course of the next several days that I am an apt student of the physiology of cold stress.

The two major physical parameters of environmental stress are temperature and pressure. The nonuniformity of work effort relating these parameters to military operations has always seemed curious to me. In the Navy, our interest in things hyperbaric has dwarfed our involvement in things hypobaric. In a similar manner, our preoccupation with heat stress and adaptation to tropical conditions has far exceeded our interest in the physiological effects of cold and arctic adaptation. I am not sure that the disparity is rational, since clearly the Navy and the Marine Corps have had a history of operations in environments at less than, as well as greater than, one atmosphere, and in areas frigid as well as sultry.

A number of examples immediately come to mind that tweak the conscience of our unpreparedness to operate effectively in maritime cold. According to Dr. Keating and others, hypothermia probably accounts for more deaths at sea following ship sinking than drowning, shark bite, starvation, or explosion put together. In submarine design and construction, elaborate, expensive, burdensome and complicated systems have been developed and deployed to permit the egress of a crew from a disabled submersible. Yet we still do not know the impact of cold exposure on non-decompression boundaries for the egress evolution, nor are we able to sustain life more than a few minutes in the survivor who reaches the surface in the cold oceans of the world. In a recent amphibious exercise in San Diego, a temperate climate by anyone's standards, there were a dozen hypothermia casualties in personnel simply swimming ashore, of which two required hospitalization. Last but not least, in Marine land-based operations the losses and inefficiencies of performance at Attu, Kiska and the Chosin Reservoir are well known to all.

With these concerns then, our immediate preoccupation is with the development of a biomedical research program that is relevant to Navy and Marine Corps needs but yet complementary to the work of other Armed Forces organizations.

As preparation for, but not preemption of the task of this work group, we have identified the following areas as those relevant to our needs, worthy of our efforts and, to our knowledge, not in conflict with work already well in progress elsewhere. These areas include:

1. The development of new, effective methods of treatment of hypothermia resulting from sudden immersion in chilled water.

2. The evaluation of the effects of cold superposed on combat trauma with specific reference to wounds, blood loss and shock.

3. The development of treatment modalities for casualties suffering from battle trauma plus hypothermia.

4. A measurement of physical and mental performance decrements for varying degrees of immersion hypothermia.

5. A better understanding of the mechanisms for acclimatization to hypothermia, with particular emphasis on the development of techniques for deliberate rapid acclimatization of personnel to be deployed in arctic marine environments.

6. The development of specialized medical equipment for life saving procedures and transportation applicable to the traumatized, hypothermic casualty.

With that I will close and offer my sincere wishes for a productive and successful workshop.

ARMY MEDICAL RESEARCH & DEVELOPMENT COMMAND CONCERNS AND PRIORITIES

COL LeeRoy G. Jones

A commentary on the preparedness of the US for cold weather operations can be found in the example of desert equipped airborne troops prepared to back up the Israelis in 1973 on the Golan Heights at the same time that these Israeli troops were experiencing hypothermia and cold injuries. There is a lack of understanding of the environmental conditions in certain regions of the world. A similar lack of preparedness is to be found to varying degrees in Europe today. We are not organized to medically support the intense form of warfare that could occur there.

This lack of preparedness arises in part from the limited military funding that generally occurs during peacetime. We are in competition with other federal agencies for funding and, frankly, we do not compete very well. There is a need to better advertise our accomplishments and needs.

In this atmosphere of limited funding and tremendous shortage of professionally trained people, there is a need to consolidate our research efforts to meet the users needs. The laboratory worker is far removed from the problems in the field, and truly does not understand the needs of the user. Emphasis needs to be placed on field medicine in the cold. Problems need to be clearly identified, prioritized; and then only those problems which our presently limited resources can support should be addressed. Other problems will have to be set aside until an increase in our support can be obtained.

In addition to the stated objectives of this meeting, it is hoped that those doing research on user needs will receive reinforcement. To those who handle the resources, develop equipment or establish medical doctrine, as these pertain to cold weather operations, it is our hope that word goes forth that our house is not in order and there is an urgent need to rectify this situation.

SEARCH & RESCUE

Chairman-CPT Charles Thompson
Recorder-CPT John Donovan

WORKING GROUP #1

SEARCH & RESCUE AND COMMUNICATIONS

1. PROBLEM

There exists a need for an improved means of locating downed aircraft and/or casualties.

RECOMMENDATIONS:

We recommend for consideration these ideas:

a. The use of a passive means of signalling rescuers.
b. The use of an infrared signalling device.
c. A hand held, manually operated, strobe signalling device.
d. Better quality ELTs (emergency locator transmitter) with an omni-directional switch to facilitate activation in a vertical fall crash situation, e.g., helicopters.

2. PROBLEM

There exists a need for more and improved communications capability for medical personnel and equipment.

RECOMMENDATIONS:

a. TOE's should be modified to include radio communication capability for each medical vehicle and each medical aidsman. These radios should have the characteristics of:

(1) Secure voice

(2) Short range

(3) Unidirectional antennas to help alleviate transmission into enemy territory.

b. This group also feels a dedicated medical communications network is a necessity.

3. PROBLEM

There exists a need for revision of Chapter 7 of the National Search and Rescue Manual.

RECOMMENDATION:

Revision

4. PROBLEM

There is a need to establish and clarify responsibilities for search and rescue missions between national defense agencies.

RECOMMENDATIONS:

We recommend a more precise definition of national defense agencies areas of responsibility with regard to search and rescue. This should include a definition of their respective logistics and support. Once these responsibilities are more clearly defined, to then insure that each agency has the appropriate equipment authorized to adequately support their mission.

5. PROBLEM

Changes are necessary in search and rescue doctrine.

RECOMMENDATIONS:

a. Insure that all search and rescue doctrine includes all-weather capability.

b. Insure that search and rescue doctrine includes the availability of dedicated search and rescue equipment.

c. Insure that training in search and rescue in cold weather is more realistic, and that more time is allotted for this training.

d. Reorganize the search and rescue effort to combine, coordinate and integrate national defense agencies.

e. Coordinate search and rescue operational plans with the medical operational plans in a given area.

6. PROBLEM

Changes are necessary in the area of transportation.

RECOMMENDATIONS:

a. Develop an improved tracked vehicle as a secondary mover of casualties. We submit that this type of equipment has already been developed by other agencies or countries, and need only be acquired, tested and supplemented. These vehicles should have the characteristics of being inclosed, heated, lightly armored and with a versatility of terrain negotiability.

b. We feel the achio equipment could be improved for medical needs in the transport of casualties, and this achio should be made compatible with a light snowmobile-like machine.

c. We recommend a small, lightweight snowmobile as TO&E equipment for use in cold weather medical evacuation.

7. PROBLEM

Several deficiencies in the area of training were identified.

RECOMMENDATIONS:

a. Include medical training for search and rescue personnel to insure adequate care.

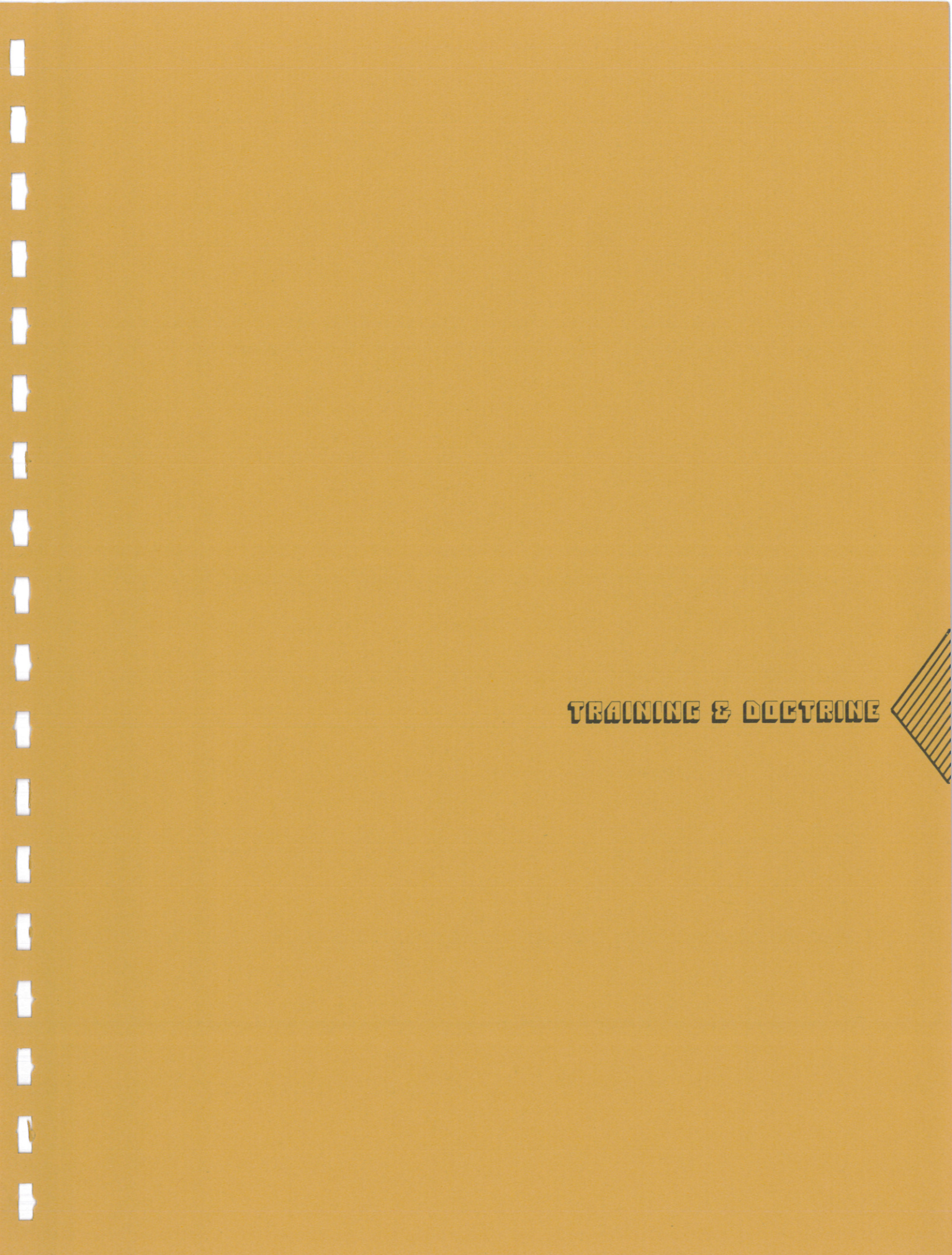
b. Medical training needs to be more specifically addressed to the cold weather scenario.

c. We recommend medical personnel attend special schools, such as the Northern Warfare Training Center in Alaska, and receive training in cold weather operations.

d. We recommend that a compendium of all schools, training sessions, courses, etc. in cold weather related areas be published as a joint effort of the armed services, national defense agencies and allied countries, e.g., Canada & Norway.

e. We recommend an Additional Skill Identifier (ASI) for medical personnel be used for those specifically trained in cold weather operations, and that this ASI be a requirement for assignment to a cold weather area.

f. Finally, we recommend more realistic cold weather field training exercises.


TRAINING & DOCTRINE

Chairman-BG Francis W. Tief
Recorder-Dr. Wilbert D. Bowers

WORKING GROUP #2

TRAINING AND DOCTRINE

A. TRAINING

1. PROBLEM

Is training of medics adequate? It was concluded by this working group that neither general nor specific training is adequate. Although the major thrust has been to shorten the training period and place individuals in their units as soon as possible for on the job training, the net effect has been an increase in the number of inadequately trained medics. Except in Alaska, there is no training in specific areas such as cold weather operations, either in schools or in the field. Neither physicians, medics nor line troops receive adequate specific training. Additional training programs are essential for all levels, and these must be repeated at appropriate intervals. The formats must be geared to the levels of training and verbal skills of the trainees.

RECOMMENDATIONS:

a. Additional training programs in general and specific skills should be made available, and utilization of these programs should be mandatory.

b. Cold weather training should be given under realistic conditions at places such as Fort Drum or Camp Ripley.

c. A system must be developed which retains information at the unit level, in spite of high turnover rates.

d. Important information on cold weather operations should be computerized, and thus readily available.

e. A check list of requirements for operations in cold weather should be developed which would insure that all of the important points relevant to operations in cold weather are considered.

f. A check list should be developed which indicates all required training for each individual, based on the units mission assignments (geographical area of responsibility).

g. A seeding program, where NCO's receive training and spread the information down, may prove to be a valuable method.

h. Developers of new equipment should maintain closer contact with users.

MINORITY COMMENT:

One individual in the group expressed the view that general training is adequate, but training for cold weather operations is inadequate.

2. PROBLEM

How should intravenous fluids be administered in the cold? Either the intravenous fluids must be administered in a warm area or the container and tubing must be heated. If bottles are used, they should be filled to no more than 80% capacity in order to reduce breakage. The use of plastic bags is probably better. Chemically heated containers are used by at least one country which also requires storage of adequate fluids in all units. Medics can administer IV fluids, but practice is essential. Even physicians must have practice to do this properly. Equipment and clothing should be designed specifically for medics; however, they can not carry everything that might be required. There must be a redundancy of medical supplies. If troops have a choice, they will carry more ammunition rather than medical supplies.

RECOMMENDATIONS:

a. There is a requirement for a device which can be used to administer IV fluids in the cold.

b. Fluids should be prewarmed.

c. Plastic bags are better than bottles for IV fluids administered in the cold. They can be placed under the patients clothing and administered with a pressure pump for flow control.

d. Vehicles can be used to keep solutions warm.

e. When bottles are used, they should not be filled above 80% capacity.

f. All troops should receive some training in case there is no medic.

3. PROBLEM

What training is necessary for recognition of cold injury, and what steps are required for the protection of traumatized patients during evacuation in the cold?

Additional training at all levels (physicians, physician's assistants, medics and line troops) in handling varying degrees of medical emergencies in the cold is essential.

RECOMMENDATIONS:

a. Training should include information on dehydration and its

manifestations, the consequences of restriction in blood flow to limbs, and the use of the buddy system for early recognition of cold injury.

b. Training should indicate to the medics that secondary problems should not be overlooked when they could influence the outcome of the major injury.

c. A vehicle (PV202) similar to that used by the Norwegians, which can pull multiple patients with one track vehicle, should be considered.

d. There must be alternatives to evacuation by helicopter, particularly in cold weather conditions where bad weather or hand held heat seeking weapons could make them ineffective. Both over-land and air modes of evacuation need further development in the evolution of a comprehensive evacuation system.

e. Resupply vehicles are generally used to evacuate casualties.

f. Since frozen extremities should not be allowed to refreeze after thawing, consideration must be given to how the patient is warmed during evacuation.

4. PROBLEM

What drugs should be administered? Morphine can be used for severe pain. Since it is not absorbed readily when given subcutaneously, a problem which is amplified by cold, injections should be given by either intravenous or intramuscular route. Morphine should be available in IV solutions, if possible, to avoid shock. There are problems associated with storage of morphine and amphetamines, but these should be available at appropriate levels. In the dog, morphine lowers the body temperature. The efficacy of its use in the cold should be studied. Some analgesics can be dissolved under the tongue and they react almost as fast as if they were given intravenously.

RECOMMENDATIONS:

a. Animal models should be used in the laboratories to study the problems associated with the use of drugs in the cold.

b. Non-sedating drugs would be better, since patients may be able to help themselves to some extent under these conditions.

5. PROBLEM

At what point should triage occur? Current doctrine is good for this point. A physician should decide who goes where, when possible. In practice, the best person available should decide. Logistics have a great impact. With frostbite, all are generally treated the same with rapid rewarming, but there must be a place for this or a warm place to hold patients. Snow caves or Landing Vehicle Tracked (LVTs) could be used for examinations. In some cases, the patients may be dangerous to others, as with NBC.

RECOMMENDATIONS:

a. Consideration should be given to the development of a table of variables which gives answers as to which patients should go where under a given set of circumstances.

b. Provisions should be made for patients exposed to NBC.

6. PROBLEM

How do we minimize the effects of NBC in cold weather? We are completely unprepared in this area, in spite of the fact that potential opponents are rapidly moving forward. There is currently no training for these potentially devastating tactics. The current gas masks are essentially useless in cold weather.

RECOMMENDATIONS:

a. More knowledge, equipment, and training are absolutely essential in NBC warfare, particularly in relation to their use in cold weather.

b. More people should be briefed on the threat analysis.

c. We must, at least, be prepared for what we know potential enemies plan to use.

7. PROBLEM

Are additional treatment techniques required? Discussion focused on the use of training aids.

RECOMMENDATIONS:

a. Medics could use manikins for learning and teaching CPR, but a physician must also be involved.

b. Training aids which are effective and economical must be provided for all levels.

c. The use of training aids must be required at all levels. The aids must be in a format that can be easily understood.

d. Television programs should be produced to train troops for specific, practical problems which they may face in cold weather operations. The Academy of Health Sciences can produce video tapes for field use.

e. Real life critical events should be used to promote new programs.

8. PROBLEM

Should large scale field exercises include medical units and simulated

casualties? How can they be most effectively refereed? "Solid Shield" operations proved that we cannot handle casualties, and that we must know what to do when the evacuation helicopters do not appear. Experience is still the best teacher. Trips into the field should include all parties who might benefit from the experience. Operations should be set up to include all units which would be involved in an actual confrontation, and commanders must be encouraged to take casualties.

RECOMMENDATIONS:

a. Operations must be comprehensive, simulating realistic conditions as much as possible, including casualties.

b. All units or individuals which would be involved in actual operations should be involved in simulated operations.

c. Line commanders must know proper steps and utilize them.

d. Referees must know something about the problems in order to evaluate performance. Operation "Solid Shield" had a school for referees.

e. After action reports must be accurate.

f. People who could benefit from observation or participation need to know when operations are taking place. The Joint Chief of Staff and Office of The Surgeon General always know about these operations.

General discussion following the session on training:

We know that we have major problems, and that medical support for operations in cold weather is very poor. Some of our problems could be solved now, if the total system were flexible enough to adjust to circumstances. We tend to be crisis oriented. Practically all the resources are applied to whatever the current crisis happens to be.

Units have been assigned responsibilities for various areas of the world, and they need to be prepared to operate in any environment which exists in their assigned areas. Most line people do not know where and how to obtain the information or equipment they need. Requests which go through channels are often lost in the process.

Positive steps should be taken to implement essential changes which were discussed at the conference:

a. Large scale operations are important, and the field operators must invite medics and others who may benefit.

b. A group could be formed to push for essential items.

c. Medical research on the efficacy of drugs in cold weather and on cold weather casualty transportation is required.

d. Intelligence should brief more people on the threat, in order to establish the realities which precipitate requirements.

e. The impact of NBC in cold weather must be understood.

f. Realistic training in NBC, particularly Nuclear and Chemical, must be given and appropriate equipment must be developed.

g. When other countries develop items that we know we need, we should apply reverse engineering (copy and improve them).

B. DOCTRINE

1. PROBLEM

What care should be given at what level? Under current doctrine, a decision is made at each level as to whether to hold, treat and return to duty, or to evacuate. This is geared to the needs of the patient and the ebb and flow of battle. Commanders prefer a conservative approach which reflects the minimum essential care which will return the soldier to the front, but medical personnel strive for optimal care at each level, as the circumstances permit. The cost of extensive treatment in forward areas is very high.

The goal remains to obtain the level of care that returns the soldier to duty in the fastest time by shipping him back rapidly to the first echelon to the rear which can perform the critical treatment. This is consistent with current doctrine and it appears to be sound. Serious problems can develop in the field when over-evacuation occurs. Commanders and physicians must stay in close contact in order to avoid this "medically sponsored retrograde operation". At the same time, a unit can not afford to retain excessive patients when mobility is required.

RECOMMENDATIONS:

a. The doctrine is good in this case, but it should be applied in a conservative fashion avoiding both over-evacuation and retention of excessive patient load where mobility is required.

b. There must be good communication between the commanders and physicians.

c. Medical personnel should receive orientation to the military and introduction to field operations.

2. PROBLEM

What support is essential? Good communications between units, availability of appropriate transportation, and mobility of medical units are very important. Since one of the main principles in frostbite care is not to thaw the frozen limb if it may refreeze, these casualties must be evacuated to the first stable point. Thus, the decision on who should be evacuated to what level following

cold injury poses additional identification problems. A general rule of thumb concerning severity of frostbite injury states that if the skin moves over the knuckle, the freeze is superficial and can be warmed locally. If the skin does not move over the knuckle, the freeze is severe. When layers beneath the surface layer, including the vascular tissue are frozen, the injury is severe. Medics must be trained to distinguish between blanched skin and more severe frostbite. A man who is trained to operate in the cold is a very valuable individual, and he may be replaced by one who has had no experience. This is further rationale for applying doctrine in a conservative fashion; however, the tactical situation may exert considerable control over both treatment and evacuation. If an individual were forced by his circumstances to walk on a frozen foot, he could expect to lose more tissue. In addition, the longer the tissue remains frozen, the greater tissue loss will be.

RECOMMENDATIONS:

a. Good communications between units are essential, therefore the impact of cold on communication systems must be considered.

b. Additional vehicles may be required in cold operations.

c. Medical units must have mobility.

d. Medics must be trained to recognize the severity of cold injuries.

3. PROBLEM

What are the evacuation requirements considering distances and number of personnel? Should more stop-off stations or warming tents be established in the evacuation chain? Who does the evacuation at each level?

This was considered to be the appropriate place to discuss the scenario of the slides shown at the hypothermia session in which a mortar team evacuated its own casualties. This is not in keeping with doctrine. First, the whole mortar platoon should not have been sent on a reconnaissance mission. When the platoon was hit, they should have called the company commander. Ordinarily, when on a reconnaissance mission, this would result in everyone getting out. However, if the commander said stay, the company aid post behind the platoon should go forward with the proper vehicle to evacuate casualties, and two men from the mortar platoon could be assigned to protect the casualties and keep them warm. The medical system was excluded from the scenario, air evacuation was eliminated and radio transmission was precluded.

To some of those present in the working group, this was considered a poor way to evaluate either medical performance or doctrine. However, others noted that such problems do occur in real situations. A good example was the siege on the "rock pile" in Vietnam where a 750 bed hospital was only 35 miles away, but no one could get in or out.

In cold climates, heated tents where troops can warm up are essential. The Marines have one warming tent per platoon behind their position. Warming

tents should be a part of the MTO&E. Medically sponsored warming tents behind the Battalion Aid Station (BAS) would have to be drawn from the next medical unit behind that station. The medics could be freed for medical duties if the warming tents were set up by support groups. Currently the support group supplies tents for the Marines, but line troops set them up.

The battalion aid station and clearing station must be as close to the front as the tactical situation allows. The best place for warming tents is at the battalion aid station. The Marines use this system and have a doctor at this point. When mobility is required they have a "tailgate service", and an aid station is set up in a M113. The Marines also convert LVTs to mobile aid stations.

The ski mounted infantry is highly mobile, fast and quiet. This approach to combat in the cold will disperse the battle field. If one or two Marine companies were deployed in this way, the medic would represent the only medical person available to the troops. Forty to 50 casualties under those circumstances would present an enormous challenge, particularly if helicopters could not land.

RECOMMENDATIONS:

a. Warming tents should be a part of the MTO&E.

b. The support command should supply these and set them up.

c. Aid stations should be as close to the tactical situation as possible.

d. Mobile medical aid stations are necessary when troops are dispersed and mobile.

e. Planners should consider the tremendous challenge which evacuation of 40 to 50 casualties would offer when encountered by ski mounted infantry.

f. Since there are situations where helicopters can not land (bad weather, enemy air cover, etc.), individuals need training in basic medical care.

4. PROBLEM

Special Requirements. Additional vehicles are generally required for operations in cold weather. Current doctrine does not allow for this increase in requirements. Planners should provide a comprehensive plan in which alternatives can be initiated as required. This should include consideration of the necessity for more vehicles and the possibility that over-land evacuation may be essential. The Norwegians provide all essential supplies within five miles, and they utilize an excellent vehicle for evacuation over snow.

One way to solve many of these problems is to develop a TO&E for medical companies in Alaska or other cold areas, a TO&E for medical companies in the middle east, and TO&E for medical companies operating in the jungle. In this

way the commander would not have to justify each requirement. When you are given a specific mission you should also be given the required equipment and personnel to do the job.

Both the Army and Marines task organize to some extent, but the Norwegians have "sahle" teams set up in the medical companies which are specifically designed to treat cold injury. This team consists of a doctor, 4 corpsmen, medical sergeant, and is equipped similar to the BAS. They perform advance resuscitation and prepare casualties for evacuation. However, they stress the fact that there should be no cold injury if troops are properly trained and equipped.

RECOMMENDATIONS:

a. There should be a TO&E for medical companies in Alaska, a TO&E for medical companies in the Middle East, and a TO&E for medical companies in jungle operations.

b. When planners assign missions, they must also provide personnel and equipment to carry out that assignment.

c. Evacuation plans must include alternatives to air evacuation. Land vehicles must be developed for use in cold operations.

d. Doctrine must consider increased mobility and provide for redundancy in the medical company.

e. The requirement for additional vehicles should be anticipated.

f. Forward medical officers should have training in the treatment of cold injury.

g. A modular concept, where the additional equipment, facilities and training could be added on to basic units, provides a sound approach.

h. The plan of the Marines to develop a single vehicle which can be modified for diverse uses also appears to be a sound approach to reducing cost and increasing flexibility.

i. A group of 8-10 consultants on cold injury should be established. These individuals could be called at any time information is required.

5. PROBLEM

How should salt tablets be used? Most participants felt that the use of salt tablets has no place in military medical care or operations. However, it was pointed out that occasionally individuals are deficient in salt intake and need some form of supplement although not in tablet form. This was demonstrated in operation "Brave Shield". Regulations require a high water intake in hot environments, but all doctrine is based on the assumption that three "B" or "C"

rations are eaten each day. Many troops eat only certain items in their rations. The potential for harm with salt tablets is so great that any supplement should be provided in some other form. Normal rations may not provide adequate nutrition for operation in cold weather. This should be studied by people who develop rations.

RECOMMENDATIONS:

a. All participants felt that salt tablets were dangerous and not required; however, when water intake is forced by regulation, but little food is consumed, a salt supplement may be necessary for some individuals.

b. Since the eating habits of the troops are bad, the people who study rations should review the caloric requirements and the salt problem for cold weather operations. Possibly the US Army Natick Research and Development Command should do this.

6. PROBLEM

What problems are associated with record keeping in the coding of both injuries and treatments? Methods of field medical record keeping should be re-evaluated. Reports on Vietnam indicate that the medical cards, as they were utilized, were a waste of time. The field medical cards were rarely completed, and when they were they were often illegible. The card itself may be too complicated for use in combat, and when sub-zero temperatures are added to this, the problems are magnified. Information on local treatment is usually not available when the soldier is given light duty then returned to regular duty. The same is probably true with mild cold injury. This results in an inaccurate evaluation of the work load at the front. Except for records of drugs, such as morphine, which have been administered, there should be no writing before the BAS. With frostbite, spontaneous rewarming might occur, but the physician should recognize this.

A pull tab system is under consideration. This would require no writing, be unaffected by water, and coded in a manner which would allow automated reading for statistical purposes.

Identification of individuals is also a problem. Dog tags alone are not enough. On some missions, where slight noises could mean death, individuals remove their dog tags. Many unique methods of identification are under study. Any new dog tag should have a dosimeter for radiation and chemicals, and contain critical medical information.

RECOMMENDATIONS:

a. Field medical record keeping, under the current system, is impractical and inadequate, particularly in sub-zero weather. Methods of field medical record keeping should be re-evaluated.

b. Treatments performed at the front are rarely known by the medical people in the rear. Neither work load nor information on drugs administered are available.

c. There should be adequate input from medical personnel on the development of a pull tab medical card for field use. Medics at the front line should have very little writing to do.

d. Medics at the front should get some feedback on the effects of their treatments. This lets them know when they are doing the proper thing.

e. Identification of individuals is a problem. When a new dog tag is developed, it should have dosimeters for chemical and radiation exposure, and contain important medical information.

f. The Academy of Health Sciences should consider these problems.

7. PROBLEM

What administrative actions are necessary for implementation of recommendations?

a. Conference participants should push for the development of a central repository for information on state of the art technology. The information should be obtained from both domestic and foreign sources.

b. Since considerable data and computer technology are available, steps should be taken to develop a system where the line commander could push a button and get all the information he needs for operations in cold areas.

c. Steps must be taken to insure that developers and planners recognize the threat. Medical intelligence should be extensively utilized. Intelligence personnel should brief more people on the threat in order to establish the realities which precipitate requirements. This suggests that they should be adequately funded.

d. The impact of NBC in cold weather must be understood.

e. Realistic training in NBC, particularly N&C, must be given and appropriate equipment must be developed.

f. When the enemy has an item we need, we should copy it or improve on it, and thus reduce development cost. Considerable research can be saved by reverse engineering.

g. Medical research on the efficacy of drugs in cold weather and on cold weather casualty transportation is required.

h. TO&E should be devised for specific climates.

i. The Academy of Health Sciences can produce training requirements for TRADOC. FORSCOM should also acknowledge that we are not prepared to operate in cold weather and push TRADOC for progress.

j. We must insist that training information be made available in usable form.

k. The users must make their requirements known.

l. Decision makers must receive pressure from both the user and developer. We must sell programs to the decision makers. At every opportunity we must let general officers know what the problems are, preferably by observation.

m. It is important that the people who run a project or develop an item are not the only individuals who evaluate it.

n. Large scale operations are important, and the field operators must invite medics and others who may benefit.

o. The Medical Department must participate in field operations when they are invited, and support their own programs.

p. The Academy of Health Sciences has agreed to consider all problems which fall under its jurisdiction.

q. All individuals or organizations which plan or make decisions on items discussed at the conference should receive copies of the final report.

r. A group could be formed to follow up on essential items.

PATIENT NEEDS

Chairman - CDR James Bond
Recorder - CPT Lynn R. Trusal

WORKING GROUP #3

INVENTORY OF PATIENT NEEDS

1. PROBLEM

Current knowledge of "cold injury prevention" is not adequately disseminated to both combat troops and their commanders who are ultimately responsible for them.

RECOMMENDATIONS:

a. The need for patient care of cold related injuries will be greatly decreased if an adequate cold injury prevention program is initiated, to include all troops and their commanders when cold weather maneuvers are planned.

b. Such a program could be included for all troops in basic training programs on a general basis, and supplemented by more specific detailed information for troops who are going to operate in cold environments.

2. PROBLEM

Adequate patient care cannot be provided for cold injury patients at the present time because current training programs are inadequate at all echelons of medical treatment.

RECOMMENDATIONS:

a. It is unanimously agreed that all personnel involved in the treatment of cold injuries must be educated in the new advances of cold injury treatment. This should include a list of "do's and don'ts" to prevent additional harm to the patient. This training must include the combat medics, the physician assistants and the physicians who will be found in rear echelons of patient care.

b. Develop a simple set of guidelines to aid in the initial assessment and treatment of cold injuries. Such guidelines will prevent further harm to the patient and improve recovery prognosis.

3. PROBLEM

The current doctrine as it relates to the role of the BAS in patient care of cold injuries is inadequate.

RECOMMENDATIONS:

a. It was generally agreed that the TO&E for the BAS needs to be modified for operations in environmental extremes.

b. There was disagreement as to the specific modifications that should occur. These included the following:

Agreement:

Need for a means of maintaining body heat of cold injured or traumatized patients.

The ability to administer at body temperature intravenous fluids to cold injuries.

Disagreement:

The need for the BAS to have a holding capability, provide supportive care, and have a mobile capability when cold related injuries are to be treated.

The extent of treatment that should be provided to the patients by the BAS.

4. PROBLEM

There are many aspects of cold injury treatment that need review, investigation and further research.

RECOMMENDATIONS:

a. Develop a means to prevent further heat loss from patients before, during and after evacuation.

b. An adequate, fast, safe and inexpensive means of detecting hypothermia is needed.

c. Determine the role of intravenous fluids in the treatment and management of cold injuries.

d. Determine what drugs can and should be used safely and effectively in the treatment of

(1) Combat injuries only

(2) Hypothermia injury only

(3) Combined combat and hypothermia injuries.

e. Determine the effects of freezing and thawing on the safety and potency of drugs and IV solutions.

f. Develop predictive, non-invasive indices which will permit improved diagnosis and treatment of cold injuries, with the goal of accelerating wound healing and/or survival.

g. Identify and recommend optimum measures to prevent hypothermia secondary to combat injury.

h. Establish doctrine relative to medical aspects of NBC operations in cold environments.

i. Evaluate the relative role of rewarming methods in the management of cold injuries.

5. PROBLEM

Need additional basic research into the pathophysiology of frostbite.

RECOMMENDATIONS:

a. Basic research is needed to determine what mechanisms are involved, and outline preventive measures that can be taken after thawing to prevent hemostasis and tissue necrosis.

b. Reliable and appropriate animal models should be developed which can be correlated with cold injuries in man.

6. PROBLEM

Need to assess man's functional performance in the cold, compounded with cumulative fatigue.

RECOMMENDATION:

Develop rapid and safe means of extending human performance without incurring cold injuries.

7. PROBLEM

Need for an up to date medical information system which will provide important data for prevention, post injury treatment, logistic development and support for doctrinal changes related to cold environment operations.

RECOMMENDATION:

Develop a medical data collection and disbursement system to compile, evaluate, and distribute pertinent data from prior conflicts, peacetime military exercises and civilian experiences in the management of cold injuries.

LOGISTICS & EQUIPMENT

Chairman-COL Robert Looney
Recorder- CPT Joel Berberich

WORKING GROUP #4

LOGISTICS & EQUIPMENT

The study group wishes to emphasize that individual equipment items will solve problems of medical evacuation only when considered as part of the entire equipment and logistics system. Moreover, equipment developments must also interface with training and doctrinal elements of the entire system of health care delivery.

1. PROBLEM

Military medical items have been and are being procured with no or inadequate testing to ascertain their effectiveness in cold climates. A pressing need exists to evaluate all medical items for climates categorized as Category 7.

RECOMMENDATIONS:

a. Evaluate all medical items, especially those utilized at the frontline, for their effectiveness in Category 7 climates.

b. Undertake testing of all medical equipment at Category 7 with great urgency.

2. PROBLEM

At present, in the absence of air evacuation, no ambulance exists to evacuate troops effectively in low temperature climates. The new commercially-obtained ambulances will have limited off-road capability. The highest priority ought to be given to development of a new off-road ambulance.

RECOMMENDATIONS:

a. An effective ground ambulance for troop evacuation should be available at all echelons of medical evacuation for use in low temperature environments.

b. Current testing efforts of the small unit support vehicle by Combat Developments Activity, Alaska should be supported maximally.

c. Any such vehicle developed should be heated and have cross country capability. For use in Alaska, the vehicle should be configured to permit transportation by helicopters; for Europe, soft-armor, especially of the top skin, should be considered.

d. The working group supports the principle that some vehicle must be provided whose sole function is that of an ambulance.

e. Due to the rough ride, a snowmobile with sled is not considered to be desirable as a ground ambulance, even should an environmentally-controlled pod be developed. However, once the small unit support vehicle is obtained, if it does not provide adequate medical evacuation, utilization of the snowmobile should be reconsidered.

3. PROBLEM

During evacuation, present equipment inadequately maintains core temperature of injured patients in low temperature environments.

RECOMMENDATIONS:

a. Present research efforts to develop a heated medical evacuation bag should continue.

b. However, it is predicted that at least 80-90% of the time, soldiers will be evacuated inside their standard sleeping bag. Development should strongly be encouraged of a means to heat the interior of this bag, such as the Norwegian charcoal kit, catalytic converters or chemical heat. In addition, some wrapping, e.g., paper, mylar or some combination or other means, should be developed to permit rapid and inexpensive insulation improvement of the standard sleeping bag.

4. PROBLEM

The field medical corpsman must identify (a) whether or not a frostbite injury exists and whether the injury is superficial or deep; (b) whether or not circumstances exist to permit rewarming with or without evacuation; and (c) what means in the field he/she can use to rewarm the patient, should that be the decision. A guiding principle to be followed absolutely is: Rewarm only when refreezing can be eliminated.

RECOMMENDATIONS:

a. Guidance and equipment must be provided to enable meaningful initiation of frostbite therapy by lower medical echelons.

b. Continue efforts in developing a letter of agreement for a lightweight, simple, rapid rewarming device for use at battalion aid stations. This device should utilize small volumes of water in a small container.

c. Conduct research to determine if a lower weight system may replace water in a rapid rewarming treatment system.

d. Conduct a feasibility study/exploratory research to ascertain if a device can be developed for determination by the corpsman whether or not tissue freezing (frostbite) exists and whether the injury is superficial or deep.

5. PROBLEM

Dehydration is a severe problem during operations in cold environments. For the sake of preventive medicine, troops must be assured of as much water intake as they utilize, minimally 2-3 quarts per day.

RECOMMENDATIONS:

a. The problem of dehydration must be corrected by emphasis on command leadership, rather than through equipment development. All soldiers and leaders must constantly be reminded of the need for water in the cold. Monitoring of snow flowers to detect dehydration and the provision of hot soup and chocolate in the field ought to be practices by leaders.

b. The present arctic canteen is inadequate. Breakage of the neck leads to water contamination; freezing of the contents often occurs. The ongoing efforts by the Combat Developments Agency, Alaska to write a requirement document for a new arctic canteen should be encouraged.

6. PROBLEM

No equipment presently available is able to maintain medical supplies at acceptable temperatures in a cold environment. This need is especially apparent for the battalion aid and clearing stations.

RECOMMENDATIONS:

a. Research and development should continue to develop a heated medical chest.

b. In the interim, the Norwegian heated medical chest should be evaluated by cold weather medical users during the winter of 1977/78.

c. With the utilization of Canadian test data, type classification of this item, if found to be appropriate, should be expedited.

7. PROBLEM

Some medicinal products, especially liquids, are adversely affected by physical/chemical changes at low temperatures. The potency, efficacy and safety of drugs may be affected.

RECOMMENDATIONS:

a. Identify, utilizing information from pharmaceutical manufacturers, which drugs in the military inventory are susceptible to adverse temperatures and disseminate this information.

b. Develop improved packaging or other treatments to improve stability of these temperature labile medicinal products.

c. Develop a simple system, e.g., color indicator, to identify when drug lots are exposed to adverse temperatures.

d. Develop systems for storage of susceptible drugs that eliminate exposure to adverse temperatures.

8. PROBLEM

Frontline medics require lighting to accomplish their mission. Fixed and non-fixed treatment facilities also must be lighted and provided with additional power for heating and for instruments.

RECOMMENDATIONS:

a. Adequate lighting and power must be provided for safe and efficient medical care delivery at all echelons.

b. Additional candles ought to be authorized at the squad and soldier level.

c. A headlamp should be developed for use in all vehicles which would provide an adequate field of light for treatment (similar to item developed by the Israeli Defense Forces).

d. A written requirement document for a new family of field generators exists, and development is ongoing for all users of electrical power. These efforts should be encouraged due to the medical need for these items.

9. PROBLEM

It is realized that medical supplies and patients will be transported by all expedient vehicles in times of combat.

RECOMMENDATION:

Under expedient conditions, damage to medical supplies and trauma to patients should be minimized. No equipment items can practically be developed to meet expedient needs. Using discretion, judgement must be exercised when patients and medical supplies are transported in non-medical vehicles. Where possible, heated cargo space should be provided for movement of patients and supplies.

10. PROBLEM

Present means for field improvisation of an evacuation sled are deficient.

RECOMMENDATION:

Health Services Command should explore the possibility of obtaining items to adapt military skis to make a field improvised litter sled, such as the Norwegian type.

11. PROBLEM

No means exist for the delivery of intravenous fluids at acceptable temperatures in a cold climate. This need is a pressing need, as expansion of fluid volume is considered to be an essential component of emergency medical treatment.

RECOMMENDATION:

Research should be conducted on a total system for IV fluid administration in the cold.

12. PROBLEM

Pneumatic splints operate inadequately in cold climates due to cracking of plastic.

RECOMMENDATION:

Apart from the utilization of field expedient splinting materials, wire mesh splint material should be provided to medics for use in cold climates.

13. PROBLEM

Tape sticks inadequately in cold climates and is difficult to unroll.

RECOMMENDATION:

Rather than develop a tape with low temperature adhesive properties (it is felt that tape is occlusive in cold climates), a systems approach should be utilized to develop new ways to apply dressings in the cold, e.g., velcro.

14. PROBLEM

No significant problem was identified for X-ray film in the cold.

15. PROBLEM

Glass bottles break and/or liquids are lost due to fluid expansion in the cold.

RECOMMENDATIONS:

a. For liquids that can stand freeze/thaw, containers should be filled appropriately to allow for expansion of fluids in the cold. This same principle ought to be applied to aerosols.

b. Whenever possible, flexible plastic containers should be used for storage of all medical products.

16. PROBLEM

Medics must conduct treatment requiring manual dexterity without risking cold injury of their own hands.

RECOMMENDATION:

The requirement for heated handware has been identified, and a written requirement document exists for handwear that operates from 24 and 28 V sources and a separate battery pack. Medics are identified as potential users of this item. Development of the handwear should be encouraged.

17. PROBLEM

No narcotic or analgesic exists which is nonsedating, nondepressing and nonhypothermogenic.

RECOMMENDATIONS:

a. Research should be conducted to develop such a pharmacologic agent.

b. In the interim, Talwin^{R} should be encouraged as a useful field analgesic.

18. PROBLEM

Differences in drug action of most (if not all) drugs in patients in cold temperature environments compared to normal ambient temperatures are largely unknown.

RECOMMENDATION:

Research should be conducted to identify differences in drug action of commonly used drugs in low temperature environments.

19. PROBLEM

Medicines utilized by the front-line medic are exposed to low temperatures and may be permanently or temporarily unsuitable for administration to patients.

RECOMMENDATIONS:

a. A systems approach should be adopted to improve transport of medicines by the medic. Such an approach should evaluate:

(1) Insulated medical bags versus

(2) Uninsulated medical bags and shirt pocket containers or insulated vests

b. Evaluation should include the study of catalytic or charcoal heating devices, and should determine whether medicines only or also IV fluids must be transported.

20. PROBLEM

Medical care in an environment compromized by chemical agents is difficult at best.

RECOMMENDATIONS:

a. All CB protective materials for ambulatory and non-ambulatory patients should be fabricated for utilization in Category 7 environments.

b. A kit should be developed for the detection of chemical agents up to Category 7 environments.

21. PROBLEM

The current composition of the basic medic (M1 bag) and even M3 and M5 bags may be inadequate for utilization in low temperature environments.

RECOMMENDATIONS:

a. In conjunction with Health Services Command, a conference should be conducted by AMEDD, Alaska and CDA, Alaska to evaluate the contents of medic's bags.

b. One specific principle to be followed is the utilization of medication in tablet form whenever feasible to minimize adverse temperature effects.

c. Specific recommendations include: Inclusion of three items for airway maintenance (a flat, non-penetrating tenaculum, a nasopharyngeal airway, and a barrel syringe with curved, pointed stylette, for opening airway).

d. To the standard M1 Kit, minimally the following should be added: moleskin, Talwin® (tablets), pHisohex®, rectal and oral low temperature thermometer, sunburn cream, benadryl (IV and tablet), benzoin tincture; ½% rather than 1% lidocaine is recommended for M5 kit.

22. PROBLEM

Deficiencies in field sanitation and personal hygiene are produced more readily in cold climates with more severe results.

RECOMMENDATIONS:

a. Command leadership must be emphasized to prevent medical problems from poor hygiene and sanitation. Field hygiene techniques must be taught enthusiastically to the troops and their utilization monitored in the field.

b. A specific equipment recommendation was the supplementary issue of moist towellettes to troops in the field.

SUMMARY OF EVENING SESSION ON ACCIDENTAL HYPOTHERMIA

In conjunction with the USARIEM/ONR "Joint Working Group on Problems of Medical Evacuation in Cold Weather", a group discussion on "Accidental Hypothermia" was held on Tuesday evening, November 1, 1977. This optional discussion was attended by fifty people, approximately 2/3 of the conference attendees. This discussion consisted of two formal opening presentations followed by a round table informal discussion, the entire meeting lasting three hours.

At the outset, Dr. Martin Nemiroff presented his recent findings about resuscitation following sudden, long duration immersion in cold fresh water. Dr. Nemiroff discussed 15 such cases: 11 survivors with no neurologic defects, 2 survivors with chronic hypoxic brain damage and 2 deaths. In all cases, individuals had been submerged from 5 to 38 minutes in water less than 70°F. Individuals were apneic, pulseless, cyanotic and neurologically impaired upon presentation to the physician, in many cases comatose and apparently clinically dead. Their mean rectal temperature was 93°F; all were hypoxic and severely acidotic. Some patients were only hypercarbic and all electrolytes were near normal.

Although his clinical sample was weighted toward younger patients, Dr. Nemiroff saw successful recoveries in adults as well. He attributes the survival to metabolic protection due to the diving reflex and to hypothermia. Dr. Nemiroff discussed three factors essential in the management of these fresh cold water, near drowning victims. First, CPR must be initiated immediately upon removal from the cold water and sustained. Second, individuals must be aggressively rewarmed; in his sample, rewarming was done by inhalation rewarming (100% FI_{O2}, 100% saturated at 42°C). Third, forced ventilation (PEEP) must be utilized to correct PA_{O2}; pH recovery then follows without additional therapy. The dramatic results that Dr. Nemiroff reported occurred with no cardiac arrhythmias.

The second presentation, by Dr. Robert Chaney, focused on the utilization of airway rewarming to resuscitate hypothermia victims. Initially, Dr. Chaney presented data from dogs which indicated that heat from airway rewarming is confined to the body core. He showed warming had occurred at the level of the azygous vein junction with the superior vena cava, while peripheral and rectal temperatures remained depressed. Dr. Chaney also presented data from 9 human subjects (3 women, 3 male cross country runners and 3 male skin divers) comparing 5 rewarming methods: (a) shivering; (b) immersion in warm water; (c) heat pads applied to the groin, rib cage and head and neck; (d) inhalation rewarming (43°C); and (e) inhalation rewarming plus heat pads. Dr. Chaney cooled these persons to a core temperature (tympanic) of 35°C and compared their time of recovery back to 35°C following "after drop". Shivering was less successful in rewarming than the other 4 methods. These four rewarming methods were not significantly different, although faster recovery time was seen using inhalation rewarming.

Dr. Chaney, in discussion, indicated that inhalation rewarming was not a panacea and could be used in conjunction with other rewarming methods. He recommended, based on its ease of use in the field and the fact that if one were force-ventilating hypothermia patients anyway, one ought to use hot air.

It was clarified that 80-85% of heat was transferred by water condensation in the lungs (Dr. Hayward), approximately 1-2 kCal/hr as dry heat and 8-10 kCal/hr as water heat content (Dr. Goldman). Using a Bennett vaporizer, a rewarming of approximately 2.5°C/hr might be expected in the core.

Following the formal presentation, Dr. Hamlet opened the meeting up for general discussion. The interaction was lively and interesting but (surprisingly) not very controversial. Dr. Doolittle possibly best summarized everyone's feelings about treating hypothermia:

"People who are well treated, do well".

The discussion intuitively resolved into proposing recommendations for the management of hypothermic victims.

Two words of caution were offered for the field treatment of hypothermics:

(a) If you treat a hypothermic victim in the field, you must be prepared to deal with the consequences. That is, in cases more severe than mild hypothermia, you must be aware of the likelihood of cardiac arrest or ventricular fibrillation and therefore treat this with sustained CPR. In general, therefore, moderate and severe hypothermic victims should be kept in their "metabolic icebox" and not rewarmed in the field.

(b) Although you may not wish to rewarm severe hypothermic patients in the field, you should prevent their further heat loss. For, if you allow his/her temperature to drop further, you increase the risk of ventricular fibrillation when rewarming is initiated.

In the military system of evacuation possibly 3 cases can be delineated.

(1) Mild hypothermia. Example, subject can walk on his/her own, subject can speak lucidly with no apparent mental changes. Rewarm this individual by whatever means available, either at battalion aid station or clearing station.

(2) Moderate hypothermia. If there is any question based on observation of the person whether he is more than mildly hypothermic, he should be evacuated to the clearing station. Transportation should be as non-traumatic as possible to prevent ventricular fibrillation. During evacuation, the individual should not be rewarmed, but further drop in body temperature should be prevented. At the clearing station, the individual should be rewarmed (as in (3)) or, based on the physician's observations, evacuated further to a field hospital.

(3) Severe Hypothermia. Individuals who are severely hypothermic should be evacuated from the battalion aid and clearing stations to a field hospital. At the field hospital, the individual should be rewarmed aggressively. The mode of rewarming is not particularly significant (e.g., warm water immersion, inhalation rewarming, peritoneal dialysis, arterio-venous shunts, etc.).

During rewarming two considerations are essential: (a) careful management of the patient to correct electrolyte and pH imbalances; (b) the ability to respond to any cardiac emergencies which might occur.

CONCLUSIONS

CONCLUSIONS AND SUMMARY

Although it is necessary to read the reports of each working group to fully understand the scope of the current problems of medical evacuation in the cold, some points were mentioned repeatedly and should be stressed as being of greater significance. In addition, there were a few controversial points on which the conferees did not reach full agreement.

The problems discussed at this joint conference are not unique to a single military service; they are shared by all. Although some of the problems have been identified in previous documents, we have made little progress toward their resolution. A significant number could be resolved merely by applying current knowledge and utilizing available equipment. A major contributing factor to the present predicament is the assignment of mission responsibilities without provision for the necessary equipment, personnel and training.

Actual field medical experience in cold weather operations, especially for hospital personnel and medical evacuation teams, is spotty or nonexistent; although medical units are expected to provide high quality medical care in all climates. Many assumptions have been made about our capabilities in a cold environment. In particular, the assumption by medical planners about the availability of adequate water and energy sources may be erroneous. After-action reports of units returning from cold weather training point to major deficiencies under these climatic conditions. A conference at Ft. Leavenworth in November 1976 on cold weather materiel needs helped to define Army-wide deficiencies, but did not stress their effects on medical performance capabilities.

This conference stressed medical performance capabilities. The following are some points which were found to be of importance by all four working groups.

It was the opinion of most conferees that general training of medics and medical personnel in field operations is sorely lacking, particularly for cold environments. This deficiency in training exists at all levels and results from lack of emphasis, experience and understanding of the gravity of the situation. It may be a false assumption that current training is a satisfactory replacement for continuous field training under realistic conditions.

Many expressed a need for a central repository and distribution point for information concerning military performance in the cold. It became apparent that we already have a large body of information which is not readily available to planning and staff officers. Since there is no central disposition point, many of the planners may not realize that this information exists, nor do they understand how to get it. This information is not unique to any one service, and it was felt that a single repository and distribution point would be adequate. It was pointed out that ARIEM's on-going effort at information management and computerization of unique environmental medicine information makes it the most likely agency to solve this problem.

It was repeatedly noted that it was not possible to identify the specific agencies responsible for solving many of the outlined problems. This difficulty probably has been the key factor in arriving at our present predicament. Its solution is of paramount importance. A single agency must have tasking responsibility for solving medical problems in environmental extremes. This point was made by Admiral Geiger and became increasingly obvious throughout the discussions. A concerted effort by the combined Surgeons General should be attempted and clear lines of responsibility and authority established. A single

agency must oversee and push for continued effort to solve these problem areas.

The increasing chemical warfare threat and our inability to deal with this threat was pointed out in a number of discussions. Special problems exist for cold weather military operations. We should not let the difficulties associated with dealing with this problem affect our continued concern for arriving at solutions in the future. This is a significant problem and requires multiservice concern and effort.

Two major controversial points arose during the discussions which were not resolved. The first was the question of air versus overland evacuation. In general, the participants were concerned by the Department of Defense policy that the modality of choice for evacuation of sick and wounded would be by aircraft. In peacetime, this policy would seem feasible although cold weather complicates air evacuation. For example, in Alaska, helicopters are reliable in only 65% of the rescue missions under cold weather conditions. In addition, not all services have adequate numbers of aircraft which can be committed to evacuation operations. In wartime, many participants felt that a lack of air superiority or the availability of hand-held heat-seeking weapons could also limit air evacuation.

The participants were in agreement that, when feasible, air evacuation should be used. However, this has been interpreted by policy makers as the sole means of evacuation, thus making it difficult to get support for development of overland vehicles specifically designed for medical evacuation in the cold.

It was concluded that policy makers must be made to understand that the wording "modality of choice" infers the existence of an adequate alternative mode of evacuation. Currently, in cold weather environments, this alternative does not exist. The development of alternative forms of evacuation vehicles would allow a commander to evaluate the prevailing conditions and thereby choose the mode of evacuation most suitable for the survival of the patient.

The second major controversial point conerned the role of the battalion aid stations (BAS) in cold weather operations. The current doctrinal role for the BAS makes no allowances for special treatments necessary for cold injuries.

In cold weather operations, a modification in the concept of the BAS is needed. Cold injuries require rewarming and once rewarmed must be protected from refreezing. It was suggested that the BAS serve as a holding point for rewarming, but it was quickly pointed out that this suggested the BAS would become a fixed facility. Such a facility cannot exist within the framework of the current BAS and still allow the BAS to meet its mission of following front line combat units as they advance.

The inclusion of a warm, mobile evacuation modality within the BAS would allow the station the necessary mobility while meeting the needs of the cold casualty. Such a vehicle could be used to hold casualties when the station could not move. Thus, in cold environments, rewarming of casualties could begin immediately after front line evacuation.

Further clarification of the role of this vehicle would be necessary to determine if it should be used just to evacuate from the point of injury to the BAS or to evacuate from the station to the rear as well. Present doctrine of the BAS does not include evacuation to the rear, medical companies come forward to transport casualties to the rear.

Although there was general agreement that the capability of administering body temperature intravenous fluids in the cold is needed, this capability is not included in current doctrine of the BAS. Thus, inclusion of such a capability would

require an additional modification in the existing TO&E for the BAS. A re-evaluation and redefinition of BAS capabilities considering the projected types of battle, terrain and weather should be made. Input from simulated battles in cold weather would be helpful in making judgements and decisions on this matter.

It is wise at this point to review the comments of Admiral Geiger in which he defined the potential value of this conference, that is, solving the problems identified. A number of his points have been achieved during discussions. The major effort now lies in directing these problems to the responsible agencies and assuring that they are addressed without delay. It should be recognized that the solutions to many of these problems are clearly an Army responsibility. However, the resolution will have multiservice application and therefore should allow for input from the research communities of all three services. The fact that the individuals participating in these working groups are experts in the field should make their findings irrefutable.

The findings and recommendations of this Joint Working Group should be utilized as a starting point for responsible medical agencies in their efforts to improve evacuation and treatment of injuries in cold weather.

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APPENDIX

FOREIGN HISTORICAL NOTES ON COLD INJURY IN WARFARE

Historically, cold injury has contributed significantly to hospitalized casualties during warfare. Foreign military forces have made fundamental errors in coping with and fighting under cold weather conditions. Mistakes were made in the decision making process from levels of high command down to the individual soldier. It is important not only to learn from our own past experiences, but also from those of foreign armed forces as well. Failure to utilize this knowledge is well exemplified by a comparison of the World War II German and the Napoleonic French offensives in Russia.

It is interesting to note that two of the most devastating military operations, with respect to cold injury occurred under such similar circumstances. The Grand Army under the previously brilliant command of Napoleon, and the German 16th Army of the winter of 1941-42, both failed with their offensive compaigns into Russia. Their failure resulted from a lack of respect and preparedness for fighting under cold weather conditions. Both armies were fighting a foe presumably more acclimatized and trained to fight under these conditions. Neither army was able logistically to maintain themselves in cold weather. Accordingly, both armies suffered heavy casualties due to cold injuries. During the period of Napoleon's retreat from outside Moscow, he lost 35,000 of his remaining 80,000 men. Severe weather conditions during the winter of 1941-42 caused the German 16th Army to suffer miserably in its Russian campaign. Frostbite accounted for 230,000 casualties. This is significant when it is considered that the total number of hospitalized frostbite cases for the period 1939-42 was 252,943. This represents 3.0% of the total hospitalized casualties for this period. However, it represents 12% of the total casualties of the winter offensive of 1941-42.

From the German experience, three important points have been identified regarding frostbite casualties. There is (1) a permanent or temporary loss of the individual; (2) an additional loss in man hours and materials for evacuation and treatment of these casualties; (3) an increased incidence of cold injury in previously afflicted personnel. Statistically, the Germans found that 40% of frostbite casualties took 3 months to recover; 30% took 6 months and 15% took 12 months or more. Ten per cent were fit for limited service and 5% were permanently unfit for service, including 1.6% deaths.

Alfred Toppe, Generalmajor in the German Army, in his report on frostbite during World War II, felt two basic shortcomings resulted in the heavy casualties during the winter offensive. These were (1) inadequate clothing and (2) insufficient instruction of the soldiers about the prevention of frostbite. He concluded: "The catastrophic experience of Napoleon's Army in 1812-13 and the German Army's experience in the winter of 1941-42 in Russia should serve as a warning to the armed forces of any nation which may be forced to live and fight under the kind of conditions prevailing in Russia."

The following are various reports from other countries dealing with cold injury during war. During World War I, 3.0% of French casualties and 2.5 to 3.5% of British casualties were due to cold injury. Similar statistics were reported by

the Soviets during their Great Patriotic War. Naval losses during this war showed that cold injury casualties were only second to battle wound casualties. Frostbite comprised 5.4% of total casualties of the Russian Navy. In the Russo-Finnish War, cold casualties were approximately 12% of total casualties.

Since an important aspect of understanding the problems of cold casualties is the evacuation of such casualties, the following historical notes dealing with evacuation are presented. Dr. Hans Killian, consultant to the 16th German Army in World War II, noted: "Frostbite suffered by men being evacuated decreases their chance for survival and recovery. Greatest care is indicated. Evacuation of wounded should be limited as much as possible during very cold weather. Unnecessary evacuation should be avoided completely." British medical observers of the Russo-Japanese War concluded that: "The excessive number of deaths in battle, however, was attributed in part to deaths from cold as the wounded lay on the battlefield before they could be picked up."

In summary, these notes are not meant to be a thorough review of cold injury in warfare. Rather they should serve to emphasize the importance of historical information in the process of military decision making.